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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b>	<b>Applicant(s)</b>
	10/601,258	STEPHAN, WOLFGANG
	<b>Examiner</b>	<b>Art Unit</b>
	Giovanna Colan	2162

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1) Responsive to communication(s) filed on 12 July 2007.  
 2a) This action is **FINAL**.                            2b) This action is non-final.  
 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4) Claim(s) 1-6,8-42 and 44-60 is/are pending in the application.  
 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.  
 5) Claim(s) \_\_\_\_\_ is/are allowed.  
 6) Claim(s) 1-6,8-42 and 44-60 is/are rejected.  
 7) Claim(s) \_\_\_\_\_ is/are objected to.  
 8) Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

9) The specification is objected to by the Examiner.  
 10) The drawing(s) filed on \_\_\_\_\_ is/are: a) accepted or b) objected to by the Examiner.  
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
 a) All    b) Some \* c) None of:  
 1. Certified copies of the priority documents have been received.  
 2. Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) Notice of References Cited (PTO-892)  
 2) Notice of Draftsperson's Patent Drawing Review (PTO-948)  
 3) Information Disclosure Statement(s) (PTO/SB/08)  
 Paper No(s)/Mail Date \_\_\_\_\_.  
 4) Interview Summary (PTO-413)  
 Paper No(s)/Mail Date \_\_\_\_\_.  
 5) Notice of Informal Patent Application  
 6) Other: \_\_\_\_\_.

**DETAILED ACTION**

1. This action is issued in response to applicant filed request for continued examination (RCE) on 07/12/2007.
2. Claims 1, 15, 25, 37, and 51 have been amended. No claims were added. Claims 7, and 43 were canceled.
3. This action is made final.
4. Claims 1 – 6, 8 – 42, and 44 – 60 are pending in this application.
5. Applicant's arguments filed 07/12/2007 have been fully considered but they are not persuasive.

***Continued Examination Under 37 CFR 1.114***

6. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 10/11/2006 has been entered.

***Claim Rejections - 35 USC § 103***

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 1 – 6, 9 –14, 16 – 30, 32 – 42, and 45 – 50, and 52 – 60 are rejected under 35 U.S.C. 103(a) as being unpatentable over Broder et al. (Broder hereinafter) (US Patent Application Pub No. 2004/0243560 A1, filed: May 30, 2003) in view of Moffat et al. (Moffat hereinafter) (Non-Patent Literature: "Self-Indexing Inverted Files for Fast Text Retrieval"; Alistar Moffat, and Justin Zobel; February 1994, 1994 Australian Database Conference, and 1994 IEEE Conference on Data Engineering).

Regarding Claim 1 and 37, Broder discloses an article comprising a machine-readable medium storing instructions operable to cause one or more machines to perform operations comprising:

determining a first value x such that x is determined as an integer corresponding to a quantity of documents including at least a majority of the index terms (Page 17 and 18, [0307] and [0314], lines 1 – 3 and 3 – 9; respectively, Broder<sup>1</sup>).

determining a second value y, where y does not exceed x, (Page 15, [0277], lines 1 – 2, **k be the smallest index, Broder**).

However, Broder does not explicitly disclose that: x is representative of a first location **for inserting** a first skip entry in an inverted index; and that the second value y determined as an integer and representative of a second location **for inserting** a second skip entry in the inverted index. On the other hand, Moffat discloses that: x is representative of a first location **for inserting** a first skip entry in an inverted index (Page 14, Section 4.1: Skipping, 1<sup>st</sup> – 3<sup>rd</sup> paragraph in that page, “if synchronization points-additional locations at which decoding can commence – **are introduced into the compressed inverted list**. For example, suppose that p1 synchronisation points are allowed.. Then the index into the inverted list contains p1 ‘document number, bit address’ pairs, and can itself be stored as a compressed sequence of ‘difference in document number, difference in bit address’...”, “...To access the compressed list to see if document *d* appears, the first skip is decoded to obtain the address a2 of the second skip, which is also decoded...”; Moffat; also see Page 18, Section 4.4

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<sup>1</sup> Wherein the top “n” documents corresponds to the documents with the majority of index terms claimed; specifically “n” corresponds to the value x claimed. The scoring procedure utilized by Broder (as disclosed in detailed in Page 16, [0286], lines 5 – 6, Broder) including terms associations with upper bounds on its maximal contribution to documents scores; wherein the maximal contributing of index terms corresponds to the majority of the index terms as claimed. Additionally, the top n scoring documents corresponds to a quantity of documents as claimed.

Implementation, 1<sup>st</sup> paragraph, "...inverted files were built with skips inserted into each list assuming that k had some fixed value ...", Moffat); and that: the second value y determined as an integer and representative of a second location for inserting a second skip entry in the inverted index (Page 14, 1<sup>st</sup> and 2<sup>nd</sup> paragraph, "...the inverted list becomes a sequence of blocks of three pairs each, with skips separating the blocks...", and "...a<sub>2</sub> is the address of the first bit of the second skip pair, a<sub>3</sub> is the address of the first bit of the third skip, and so on...", Moffat; and also see Page 14, 4<sup>th</sup> paragraph, "a Golomb code is used for both the **inverted lists and the two components of the skips inserted into each.**", Moffat). It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the Moffat's teachings to the system Broder. Skilled artisan would have been motivated to do so, as suggested by Moffat (Page 15 and 16, paragraph 5, and 2; respectively, Moffat), to insert skips and compress inverted lists to allow both disk space and query processing time to be reduced by having a faster inverted file index by fetching fewer terms and list. In addition, both of the references (Broder and Moffat) teach features that are directed to analogous art and they are directed to the same field of endeavor, such as, databases management systems, inverted lists, skipping, and indexing. This close relation between both of the references highly suggests an expectation of success.

Furthermore, the combination of Broder in view of Moffat discloses: generating the inverted index for the collection of documents (Page 9, [0162], lines 1 – 3, Broder; and Page 1, Abstract, "...an internal index in each inverted list...")

Moffat), the inverted index including an inverted list for each of the index terms (Page 14, [0244], lines 2 – 3, Broder), each inverted list including at least one posting (Page 14, [0244], lines 2 – 5, Broder) and, if the number of postings exceeds x (Page 14, [0245], lines 7 – 10, Broder<sup>2</sup>), further including the first skip entry **inserted** after the xth posting (Page 14, [0245], lines 10 – 12, Broder; Page 13, Section: 4.1 Skipping, “...When  $k < p$ , faster performance is possible if synchronization points-additional locations at which decoding can commence-are introduced into the compressed inverted list...”, Moffat; and also see Page 18, Section 4.4 Implementation, 1<sup>st</sup> paragraph, “...**inverted files were built with skips inserted** into each list assuming that  $k$  had some fixed value ...”, Moffat) and one or more second skip entries **inserted** thereafter at intervals of every  $y$ th posting (Page 15, [0277], lines 1 – 6, Broder<sup>3</sup>; Page 14, 1<sup>st</sup> and 2<sup>nd</sup> paragraph, “...the inverted list becomes a sequence of blocks of three pairs each, with skips separating the blocks...”, and “... $a_2$  is the address of the first bit of the second skip pair,  $a_3$  is the address of the first bit of the third skip, and so on...”, Moffat and also see Page 14, 4<sup>th</sup> paragraph, “a Golomb code is used for both the **inverted lists and the two components of the skips inserted into each.**”, Moffat);

wherein:

the at least one posting includes a document identifier identifying a document in the collection of documents (Page 14, [0244], lines 1 – 6, document unique

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<sup>2</sup>Broder discloses that the method `next(id)` (page 14, [0245], lines 8 – 10). This method states that if there is **not** such document which  $DID \geq id$  (where  $DID$  = number of documents, and  $id$  = number of posting), then the term iterator returns a special posting that is larger than all the existing  $DID$ s. This implies that, if there is  $DID < id$  (the number of postings exceeds the number of documents entered), then the iterator returns the special posting mentioned above.

<sup>3</sup> The cursor is advanced to the position of  $k$  value. There is a skip at the  $k$ th value.

identifier DID, Broder; and Page 3, Section 2: Document Database, 1<sup>st</sup> paragraph, "Each document is known by a unique identifier...", Moffat);

the first and second skip entries including a document identifier that is included in a boundary posting of a block of postings immediately adjacent to the skip entry in the inverted list (Page 15, [0277], lines 1 – 6, Border<sup>4</sup>; and Page 13, Section 4.1 Skipping, 6<sup>th</sup> paragraph, "... For example, suppose that p1 synchronisation points are allowed. Then the index into the inverted list contains p1 'document number, bit address' pairs, and can itself be stored as a compressed sequence of 'difference in document number, difference in bit address'..."; Moffat), where a block of postings includes postings having document identifiers ranging from a lower to an upper value and where a boundary posting is a posting having a document identifier of either the lower or the upper value (Page 16 and 18, [0286] and [0314], lines 5 – 9 and 3 – 9; respectively, Broder).

Regarding Claims 2, and 38, the combination of Broder in view of Moffat discloses a method, wherein each posting further includes a position identifier identifying a position of the index term in the document (Page 14, [0244], lines 8 – 9, offsets of occurrences, Broder), and a frequency of the index term occurring in the document (Page 14 and 18, [0244] and [0316], lines 7 – 8 and 9 – 11, number of occurrences of the terms/ frequency; respectively, Broder).

Regarding Claims 3, and 39, the combination of Broder in view of Moffat discloses a method, wherein the boundary posting includes a document identifier having the lower value in the range of values and the block of postings follow the first skip entry in the inverted list (Fig. 27, item 5, Page 16 and 17, [0301], lines 10 – 18; Broder<sup>5</sup>; and Page 14, Section 4.1: Skipping, 1<sup>st</sup> – 3<sup>rd</sup> paragraph in that page, “if synchronization points-additional locations at which decoding can commence – are introduced into the compressed inverted list...”, “...To access the compressed list to see if document *d* appears, the first skip is decoded to obtain the address a2 of the second skip, which is also decoded...”; Moffat).

Regarding Claims 4, and 40, the combination of Broder in view of Moffat discloses a method, wherein the first skip entry further includes information to locate the next skip entry in the inverted list (Fig. 27, items 13 and 22, Broder<sup>6</sup>; and Page 14, Section 4.1: Skipping, 1<sup>st</sup> – 3<sup>rd</sup> paragraph in that page, “if synchronization points-additional locations at which decoding can commence – are introduced into the compressed inverted list...”, “...To access the compressed list to see if document *d* appears, the first skip is decoded to obtain the address a2 of the second skip, which is also decoded...”; Moffat).

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<sup>4</sup> Wherein doc\_i corresponds to the document identifier claimed. In addition, the step of advancing the cursor to next doc\_l k corresponds to the step of

<sup>5</sup> According to Broder, the pivot DID is the smallest DID that might be a candidate (Page 17, [0301], lines 17 – 18). In addition, Broder discloses that this pivot term goes through an “if” statement which finds a first pivot term with UB (upper bound) greater than the threshold (Fig. 27, item 5). This implies that the “next” method will return the smallest possible document number following the last one. In addition, the smallest document number corresponds to the lower value claimed.

<sup>6</sup> Posting[aterm] (located in the function next()) represents the information to locate next skip.

Regarding Claims 5, and 41, the combination of Broder in view of Moffat discloses a method, wherein the boundary posting includes a document identifier having the higher value in the range of values and the block of postings precede the first skip entry in the inverted list (Page 17, [0302], lines 22 – 26, Broder<sup>7</sup>; and Page 14, Section 4.1: Skipping, 1<sup>st</sup> – 3<sup>rd</sup> paragraph in that page, “if synchronization points-additional locations at which decoding can commence – are introduced into the compressed inverted list...”, “...To access the compressed list to see if document *d* appears, the first skip is decoded to obtain the address a2 of the second skip, which is also decoded...”; Moffat).

Regarding Claims 6, and 42, the combination of Broder in view of Moffat discloses a method, wherein the first skip entry further includes information to locate the next skip entry in the inverted list (Fig. 27, items 13 and 22, Broder<sup>8</sup>; and Page 14, Section 4.1: Skipping, 1<sup>st</sup> – 3<sup>rd</sup> paragraph in that page, “if synchronization points-additional locations at which decoding can commence – are introduced into the compressed inverted list...”, “...To access the compressed list to see if document *d* appears, the first skip is decoded to obtain the address a2 of the second skip, which is also decoded...”; Moffat).

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<sup>7</sup> The next() function iterates through the list and selects from the preceding terms the term with the location greater (largest document number of documents) than the pivot location. Wherein the location greater (largest document number of documents) than the pivot location corresponds to the higher value as claimed.

Regarding Claims 9, and 45, the combination of Broder in view of Moffat discloses a method, wherein the collection of one or more documents includes one or more binary files, data tables, source code files, text documents or combinations thereof (Page 9, [0158], lines 1 – 13, Broder).

Regarding Claims 10, and 46, the combination of Broder in view of Moffat discloses a method including all the limitations of claim 1, and 37, as disclosed above, further comprising:

compressing the inverted index (Page 15, [0273], lines 1 – 3, zipping, Broder).

Regarding Claims 11, and 47, the combination of Broder in view of Moffat discloses a method, wherein substantially all of the index terms occur in x documents or fewer (Page 15, [0257], lines 14 – 16, Broder).

Regarding Claims 12, and 48, the combination of Broder in view of Moffat discloses a method, wherein at least approximately 80% of the index terms occur in x documents (Page 17, [0307], lines 1 – 3, top n results, Broder).

Regarding Claims 13, and 49, the combination of Broder in view of Moffat discloses a method, wherein for each inverted list, if the number of postings exceeds x, further including a skip entry before the first posting in the inverted list (Page 15, [0257],

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<sup>8</sup> Posting[aterm] (located in the function next()) represents the information to locate next skip.

lines 12 – 20, the result is inserted, Broder; and Page 14, Section 4.1: Skipping, 1<sup>st</sup> – 3<sup>rd</sup> paragraph in that page, “if synchronization points-additional locations at which decoding can commence – are introduced into the compressed inverted list...”, “...To access the compressed list to see if document *d* appears, the first skip is decoded to obtain the address a2 of the second skip, which is also decoded...”; Moffat).

Regarding Claims 14, and 50, the combination of Broder in view of Moffat discloses a method, wherein for each inverted list, if the number of postings exceeds *x* (Page 14, [0245], lines 7 – 10, Broder<sup>9</sup>), further including a skip entry after the last posting in the inverted list (Page 14, [0245], lines 10 – 12, Broder; and Page 14, Section 4.1: Skipping, 1<sup>st</sup> – 3<sup>rd</sup> paragraph in that page, “if synchronization points-additional locations at which decoding can commence – are introduced into the compressed inverted list...”, “...To access the compressed list to see if document *d* appears, the first skip is decoded to obtain the address a2 of the second skip, which is also decoded...”; Moffat).

Regarding Claims 16, and 52, the combination of Broder in view of Moffat discloses a method, wherein each posting further includes, a position identifier identifying a position of the index term in the document (Page 14, [0244], lines 8 – 9, offsets of occurrences, Broder), and a frequency of the index term occurring in the

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<sup>9</sup>Broder discloses that the method next(id) (page 14, [0245], lines 8 – 10). This method states that if there is **not** such document which DID >=id (where DID = number of documents, and id = number of posting), then the term iterator returns a special posting that is larger than all the existing DIDs. This implies that, if

document (Page 14 and 18, [0244] and [0316], lines 7 – 8 and 9 – 11, number of occurrences of the terms/ frequency; respectively, Broder).

Regarding Claims 17, and 53, the combination of Broder in view of Moffat discloses a method, wherein wherein the boundary posting includes a document identifier having the lower value in the range of values and the block of postings follow the first skip entry in the inverted list (Fig. 27, item 5, Page 16 and 17, [0301], lines 10 – 18, Broder<sup>10</sup>; and Page 14, Section 4.1: Skipping, 1<sup>st</sup> – 3<sup>rd</sup> paragraph in that page, “if synchronization points-additional locations at which decoding can commence – are introduced into the compressed inverted list...”, “...To access the compressed list to see if document *d* appears, the first skip is decoded to obtain the address a2 of the second skip, which is also decoded...”; Moffat).

Regarding Claims 18, and 54, the combination of Broder in view of Moffat discloses a method, wherein the first skip entry further includes information to locate the next skip entry in the inverted list (Fig. 27, items 13 and 22, Broder<sup>11</sup> and Page 14, Section 4.1: Skipping, 1<sup>st</sup> – 3<sup>rd</sup> paragraph in that page, “if synchronization points- additional locations at which decoding can commence – are introduced into the

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there is DID < id (the number of postings exceeds the number of documents entered), then the iterator returns the special posting mentioned above.

<sup>10</sup> According to Broder, the pivot DID is the smallest DID that might be a candidate (Page 17, [0301], lines 17 – 18). In addition, Broder discloses that this pivot term goes through an “if” statement which finds a first pivot term with UB (upper bound) greater than the threshold (Fig. 27, item 5). This implies that the “next” method will return the smallest possible document number following the last one. In addition, the smallest document number corresponds to the lower value claimed.

<sup>11</sup> Posting[aterm] (located in the function next()) represents the information to locate next skip.

compressed inverted list...”, “...To access the compressed list to see if document *d* appears, the first skip is decoded to obtain the address a2 of the second skip, which is also decoded...”; Moffat).

Regarding Claims 19, and 55, the combination of Broder in view of Moffat discloses a method, wherein the boundary posting includes a document identifier having the higher value in the range of values and the block of postings precede the first skip entry in the inverted list (Page 17, [0302], lines 22 – 26, Broder<sup>12</sup>; and Page 14, Section 4.1: Skipping, 1<sup>st</sup> – 3<sup>rd</sup> paragraph in that page, “if synchronization points-additional locations at which decoding can commence – are introduced into the compressed inverted list...”, “...To access the compressed list to see if document *d* appears, the first skip is decoded to obtain the address a2 of the second skip, which is also decoded...”; Moffat).

Regarding Claims 20, and 56, the combination of Broder in view of Moffat discloses a method, wherein the first skip entry further includes information to locate the next skip entry in the inverted list (Fig. 27, items 13 and 22, Broder<sup>13</sup>; and Page 14, Section 4.1: Skipping, 1<sup>st</sup> – 3<sup>rd</sup> paragraph in that page, “if synchronization points-additional locations at which decoding can commence – are introduced into the compressed inverted list...”, “...To access the compressed list to see if document *d*

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<sup>12</sup> The next() function iterates through the list and selects from the preceding terms the term with the location greater (largest document number of documents) than the pivot location. Wherein the location greater (largest document number of documents) than the pivot location corresponds to the higher value as claimed.

appears, the first skip is decoded to obtain the address a2 of the second skip, which is also decoded..."; Moffat).

Regarding Claims 21, and 57, the combination of Broder in view of Moffat discloses a method, wherein substantially all of the index terms occur in x documents or fewer (Page 15, [0257], lines 14 – 16, Broder).

Regarding Claims 22, and 58, the combination of Broder in view of Moffat discloses a method, wherein approximately 80 to 90% of the index terms occur in x documents or fewer (Page 17, [0307], lines 1 – 3, top n results, Broder).

Regarding Claims 23, and 59, the combination of Broder in view of Moffat discloses a method, wherein for each inverted list, if the number of postings exceeds x, further including a skip entry before the first posting in the inverted list (Page 15, [0257], lines 12 – 20, the result is inserted, Broder; and Page 14, Section 4.1: Skipping, 1<sup>st</sup> – 3<sup>rd</sup> paragraph in that page, "if synchronization points-additional locations at which decoding can commence – are introduced into the compressed inverted list...", "...To access the compressed list to see if document *d* appears, the first skip is decoded to obtain the address a2 of the second skip, which is also decoded..."; Moffat).

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<sup>13</sup> Posting[aterm] (located in the function next()) represents the information to locate next skip.

Regarding Claims 24, and 60, the combination of Broder in view of Moffat discloses a method, wherein for each inverted list, if the number of postings exceeds x (Page 14, [0245], lines 7 – 10, Broder<sup>14</sup>), further including a skip entry after the last posting in the inverted list (Page 14, [0245], lines 10 – 12, Broder; and Page 14, Section 4.1: Skipping, 1<sup>st</sup> – 3<sup>rd</sup> paragraph in that page, “if synchronization points-additional locations at which decoding can commence – are introduced into the compressed inverted list...”, “...To access the compressed list to see if document *d* appears, the first skip is decoded to obtain the address a2 of the second skip, which is also decoded...”; Moffat).

Regarding Claim 25, the combination of Broder in view of Moffat discloses an inverted index for a collection of documents (Page 9, [0162], lines 1 – 3, Broder), each document comprising one or more index terms (Page 14, [0244], lines 3 – 5, Broder), the inverted index comprising:

an inverted list for each index term in the collection of documents (Page 14, [0244], lines 2 – 3, Broder); and

one or more inverted lists including a quantity of postings (Page 14, [0244], lines 2 – 5, Broder) that exceeds a value x (Page 14, [0245], lines 7 – 10, Broder), a skip entry inserted after the xth posting (Page 14, [0245], lines 10 – 12, Broder and also see Page 18, Section 4.4 Implementation, 1<sup>st</sup> paragraph, “...inverted files were built with

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<sup>14</sup>Broder discloses that the method next(id) (page 14, [0245], lines 8 – 10). This method states that if there is **not** such document which DID >=id (where DID = number of documents, and id = number of posting), then the term iterator returns a special posting that is larger than all the existing DIDs. This

**skips inserted** into each list assuming that  $k$  had some fixed value ...", Moffat), and one or more additional skip entries inserted thereafter at intervals of every  $y$ th posting (Page 15, [0277], lines 1 – 6, Broder<sup>15</sup>; and Page 14, Section 4.1: Skipping, 1<sup>st</sup> – 3<sup>rd</sup> paragraph in that page, "if synchronization points-additional locations at which decoding can commence – are introduced into the compressed inverted list...", "...To access the compressed list to see if document  $d$  appears, the first skip is decoded to obtain the address  $a_2$  of the second skip, which is also decoded..."; Moffat and also see Page 14, 4<sup>th</sup> paragraph, "a Golomb code is used for both the **inverted lists and the two components of the skips inserted into each.**", Moffat), where the value  $x$  is determined as an integer corresponding to a quantity of documents including at least a majority of the index terms (Page 17 and 18, [0307] and [0314], lines 1 – 3 and 3 – 9; respectively, Broder<sup>16</sup>) and the value  $y$  is determined as an integer and does not exceed the value  $x$  (Page 15, [0277], lines 1 – 2, Broder<sup>17</sup>);

wherein:

a posting includes a document identifier identifying a document in the collection of documents (Page 14, [0244], lines 1 – 6, document unique identifier DID, Broder);

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implies that, if there is  $DID < id$  (the number of postings exceeds the number of documents entered), then the iterator returns the special posting mentioned above.

<sup>15</sup> The cursor is advanced to the position of  $k$  value. There is a skip at the  $k$ th value.

<sup>16</sup> Wherein the top " $n$ " documents corresponds to the documents with the majority of index terms claimed; specifically " $n$ " corresponds to the value  $x$  claimed. The scoring procedure utilized by Broder (as disclosed in detailed in Page 16, [0286], lines 5 – 6, Broder) including terms associations with upper bounds on its maximal contribution to documents scores; wherein the maximal contributing of index terms corresponds to the majority of the index terms as claimed. Additionally, the top  $n$  scoring documents corresponds to a quantity of documents as claimed.

<sup>17</sup>  $Y$  would be the **smallest index  $k$** . And  $x$  would be the top  $n$  documents (the size of the heap) (Page 15, [0257], lines 15 – 16).

a skip entry includes a document identifier that is included in a boundary posting of a block of postings immediately adjacent to the skip entry in the inverted list (Page 15, [0277], lines 1 – 6, Border<sup>18</sup>; and Page 14, Section 4.1: Skipping, 1<sup>st</sup> – 3<sup>rd</sup> paragraph in that page, “if synchronization points-additional locations at which decoding can commence – are introduced into the compressed inverted list...”, “...To access the compressed list to see if document *d* appears, the first skip is decoded to obtain the address *a*<sub>2</sub> of the second skip, which is also decoded...”; Moffat), where a block of postings includes postings having document identifiers ranging from a lower to an upper value and where a boundary posting is a posting having a document identifier of either the lower or the upper value (Page 16 and 18, [0286] and [0314], lines 5 – 9 and 3 – 9; respectively, Broder).

Regarding Claim 26, the combination of Broder in view of Moffat discloses an inverted index, wherein each posting further includes position identifier identifying a position of the index term in the document (Page 14, [0244], lines 8 – 9, offsets of occurrences, Broder), and a frequency of the index term occurring in the document (Page 14 and 18, [0244] and [0316], lines 7 – 8 and 9 – 11, number of occurrences of the terms/ frequency; respectively, Broder).

Regarding Claim 27, the combination of Broder in view of Moffat discloses an inverted index, wherein the boundary posting includes a document identifier having the

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<sup>18</sup> Wherein doc\_i corresponds to the document identifier claimed.

lower value in the range of values and the block of postings follow the first skip entry in the inverted list (Fig. 27, item 5, Page 16 and 17, [0301], lines 10 – 18, Broder<sup>19</sup>; and Page 14, Section 4.1: Skipping, 1<sup>st</sup> – 3<sup>rd</sup> paragraph in that page, “if synchronization points-additional locations at which decoding can commence – are introduced into the compressed inverted list...”, “...To access the compressed list to see if document *d* appears, the first skip is decoded to obtain the address a2 of the second skip, which is also decoded...”; Moffat).

Regarding Claim 28, the combination of Broder in view of Moffat discloses an inverted index, wherein the first skip entry further includes information to locate the next skip entry in the inverted list (Fig. 27, items 13 and 22, Broder<sup>20</sup>; and Page 14, Section 4.1: Skipping, 1<sup>st</sup> – 3<sup>rd</sup> paragraph in that page, “if synchronization points-additional locations at which decoding can commence – are introduced into the compressed inverted list...”, “...To access the compressed list to see if document *d* appears, the first skip is decoded to obtain the address a2 of the second skip, which is also decoded...”; Moffat).

Regarding Claim 29, the combination of Broder in view of Moffat discloses an inverted index, wherein the boundary posting includes a document identifier having the

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<sup>19</sup> According to Broder, the pivot DID is the smallest DID that might be a candidate (Page 17, [0301], lines 17 – 18). In addition, Broder discloses that this pivot term goes through an “if” statement which finds a first pivot term with UB (upper bound) greater than the threshold (Fig. 27, item 5). This implies that the “next” method will return the smallest possible document number following the last one. In addition, the smallest document number corresponds to the lower value claimed.

<sup>20</sup> Posting[aterm] (located in the function next()) represents the information to locate next skip.

higher value in the range of values and the block of postings precede the first skip entry in the inverted list (Page 17, [0302], lines 22 – 26, Broder<sup>21</sup>; and Page 14, Section 4.1: Skipping, 1<sup>st</sup> – 3<sup>rd</sup> paragraph in that page, “if synchronization points-additional locations at which decoding can commence – are introduced into the compressed inverted list...”, “...To access the compressed list to see if document *d* appears, the first skip is decoded to obtain the address a2 of the second skip, which is also decoded...”; Moffat).

Regarding Claim 30, the combination of Broder in view of Moffat discloses an inverted index, as disclosed above, wherein the first skip entry further includes information to locate the next skip entry in the inverted list (Fig. 27, items 13 and 22, Broder<sup>22</sup>; and Page 14, Section 4.1: Skipping, 1<sup>st</sup> – 3<sup>rd</sup> paragraph in that page, “if synchronization points-additional locations at which decoding can commence – are introduced into the compressed inverted list...”, “...To access the compressed list to see if document *d* appears, the first skip is decoded to obtain the address a2 of the second skip, which is also decoded...”; Moffat).

Regarding Claim 32, the combination of Broder in view of Moffat discloses an inverted index, wherein substantially all of the index terms occur in x documents or fewer (Page 15, [0257], lines 14 – 16, Broder).

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<sup>21</sup> The next() function iterates through the list and selects from the preceding terms the term with the location greater (largest document number of documents) than the pivot location. Wherein the location greater (largest document number of documents) than the pivot location corresponds to the higher value as claimed.

Regarding Claim 33, the combination of Broder in view of Moffat discloses an inverted index, wherein approximately 80% of the index terms occur in x documents (Page 17, [0307], lines 1 – 3, top n results, Broder).

Regarding Claim 34, the combination of Broder in view of Moffat discloses an inverted index, wherein the collection of one or more documents includes one or more binary files, data tables, source code files, text documents or combinations thereof (Page 9, [0158], lines 1 – 13, Broder).

Regarding Claim 35, the combination of Broder in view of Moffat discloses an inverted index, wherein the one or more inverted lists further include a skip entry before the first posting in the inverted list (Page 15, [0257], lines 12 – 20, the result is inserted, Broder; and Page 14, Section 4.1: Skipping, 1<sup>st</sup> – 3<sup>rd</sup> paragraph in that page, “if synchronization points-additional locations at which decoding can commence – are introduced into the compressed inverted list...”, “...To access the compressed list to see if document *d* appears, the first skip is decoded to obtain the address a2 of the second skip, which is also decoded...”; Moffat).

Regarding Claim 36, the combination of Broder in view of Moffat discloses an inverted index, wherein the one or more inverted lists further include a skip entry after the last posting in the inverted list (Page 14, [0245], lines 10 – 12, Broder; and Page 14,

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<sup>22</sup> Posting[aterm] (located in the function next()) represents the information to locate next skip.

Section 4.1: Skipping, 1<sup>st</sup> – 3<sup>rd</sup> paragraph in that page, “if synchronization points – additional locations at which decoding can commence – are introduced into the compressed inverted list...”, “...To access the compressed list to see if document  $d$  appears, the first skip is decoded to obtain the address  $a_2$  of the second skip, which is also decoded...”; Moffat).

9. Claim 8, 15, 31, 44, and 51 are rejected under 35 U.S.C. 103(a) as being unpatentable over Broder et al. (Broder hereinafter) (US Patent Application Pub No. 2004/0243560 A1, filed: May 30, 2003), in view of Moffat et al. (Moffat hereinafter) (Non-Patent Literature: “Self-Indexing Inverted Files for Fast Text Retrieval”; Alistair Moffat, and Justin Zobel; February 1994, 1994 Australian Database Conference, and 1994 IEEE Conference on Data Engineering), and further in view of Young et al. (Young hereinafter) (US Patent No. 5,838,950, issued: November 17, 1998).

Regarding Claim 8, and 44, the combination of Broder in view of Moffat discloses all the limitations as discussed above including: wherein  $x$  is selected and  $y$  is selected, wherein  $y$  is not selected to have the same value as  $x$  (Page 15, [0277], lines 1 – 2,  $k$  be the smallest index, Broder; and Page 13, Section 4.1 Skipping, paragraph 1, “...suppose that  $p_1$  synchronisation points are allowed. The index into the inverted list contains  $p_1$  “document number, bit address” pairs, and can itself be stored as a compressed sequence of “difference in document number, difference in bit address run lengths...”, Moffat). However, Broder is silent with respect to a first range of 256 to 512

and a second range of 128 to 256. On the other hand, Young discloses a system including bits and bytes including ranges of 256 to 512, and of 128 to 256 (Col. 140, lines 30 – 43, Young). It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the Young's teachings to the system of Broder, by selecting the values of x and y according to ranges. Skilled artisan would have been motivated to select the values of x and y from ranges 256 to 512, and of 128 to 256, as suggested by Young (Col. 4, lines 1 – 5 and 38 – 43, Young), to provide a higher speed system, "leading" address byte offset to a specified bit boundary, and "trailing" address byte offsets. In addition, the applied references (Broder, Moffat, and Young) teach features that are directed to analogous art and they are directed to the same field of endeavor of database management system, such as, data manipulation, and indexing, and values representative of locations. This relation between the applied references highly suggests an expectation of success. Additionally and to further clarify, it would have been obvious to one of ordinary skill in the art at the time the invention was made to select the values from those ranges, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

Regarding Claim 15, and 51, the combination of Broder in view of Moffat and further in view of Young discloses an article comprising a machine-readable medium storing instructions operable to cause one or more machines to perform operations comprising:

receiving a collection of documents, each document comprising one or more index terms (Page 14, [0244], lines 3 – 5, Broder);

determining a first value x representative of first location for inserting a first skip entry in an inverted index (Page 14, Section 4.1: Skipping, 1<sup>st</sup> – 3<sup>rd</sup> paragraph in that page, “if synchronization points-additional locations at which decoding can commence – **are introduced into the compressed inverted list**. For example, suppose that p1 synchronisation points are allowed. Then the index into the inverted list contains p1 ‘document number, bit address’ pairs, and can itself be stored as a compressed sequence of ‘difference in document number, difference in bit address’...”, “...To access the compressed list to see if document *d* appears, the first skip is decoded to obtain the address a2 of the second skip, which is also decoded...”; Moffat), wherein at least a majority of the index terms occur in x documents (Page 17 and 18, [0307] and [0314], lines 1 – 3 and 3 – 9; respectively, Broder<sup>23</sup>) and x is an integer (Page 10, [0182], lines 6 – 8, Broder) in a first range of 256 to 512 (Col. 140, lines 30 – 43, Young);

determining a second value y representative of second location for inserting a second skip entry in an inverted index (Page 14, 1<sup>st</sup> and 2<sup>nd</sup> paragraph, “...the inverted list becomes a sequence of blocks of three pairs each, with skips separating the blocks...”, and “...a2 is the address of the first bit of the second skip pair, a3 is the address of the first bit of the third skip, and so on...”, Moffat and also see Page 14, 4<sup>th</sup> paragraph, “a Golomb code is used for both the **inverted lists and the two**

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<sup>23</sup> Wherein the top “n” documents corresponds to the documents with the majority of index terms claimed; specifically “n” corresponds to the value x claimed. The scoring procedure utilized by Broder (as disclosed in detailed in Page 16, [0286], lines 5 – 6, Broder) including terms associations with upper bounds on its

**components of the skips inserted into each.**", Moffat), wherein **y** does not exceed the value of **x** (Page 15, [0277], lines 1 – 2, **k be the smallest** index, Broder) and is an integer (Page 10, [0182], lines 6 – 8, Broder) in a second range of 128 to 256 (Col. 140, lines 30 – 43, Young);

generating the inverted index for the collection of documents (Page 9, [0162], lines 1 – 3, Broder; and Page 1, Abstract, "...an internal index in each inverted list...", Moffat), the inverted index including an inverted list for each of the index terms (Page 14, [0244], lines 2 – 3, Broder), each inverted list including at least one posting (Page 14, [0244], lines 2 – 5, Broder) and, if the number of postings exceeds **x** (Page 14, [0245], lines 7 – 10, Broder<sup>24</sup>), further including the first skip entry inserted after the **x**th posting (Page 14, [0245], lines 10 – 12, Broder; and Page 13, Section: 4.1 Skipping, "...When **k<<p**, faster performance is possible if synchronization points-additional locations at which decoding can commence-are introduced into the compressed inverted list...", Moffat and also see Page 18, Section 4.4 Implementation, 1<sup>st</sup> paragraph, "...**inverted files were built with skips inserted** into each list assuming that **k** had some fixed value ...", Moffat) and one or more second skip entries inserted thereafter at intervals of every **y**th posting (Page 15, [0277], lines 1 – 6, Broder<sup>25</sup>; and Page 14, 1<sup>st</sup> and 2<sup>nd</sup> paragraph, "...the inverted list becomes a sequence of blocks of

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maximal contribution to documents scores; wherein the maximal contributing of index terms corresponds to the majority of the index terms as claimed.

<sup>24</sup>Broder discloses that the method `next(id)` (page 14, [0245], lines 8 – 10). This method states that if there is **not** such document which `DID >= id` (where `DID` = number of documents, and `id` = number of posting), then the term iterator returns a special posting that is larger than all the existing `DIDs`. This implies that, if there is `DID < id` (the number of postings exceeds the number of documents entered), then the iterator returns the special posting mentioned above.

<sup>25</sup> The cursor is advanced to the position of **k** value. There is a skip entry at the **k**th value.

three pairs each, with skips separating the blocks...”, and “...a2 is the address of the first bit of the second skip pair, a3 is the address of the first bit of the third skip, and so on...”, Moffat and also see Page 14, 4<sup>th</sup> paragraph, “a Golomb code is used for both the **inverted lists and the two components of the skips inserted into each.**”, Moffat).

wherein:

the at least one posting includes a document identifier identifying a document in the collection of documents (Page 14, [0244], lines 1 – 6, document unique identifier DID, Broder; and Page 3, Section 2: Document Database, 1<sup>st</sup> paragraph, “Each document is known by a unique identifier...”, Moffat);

the first and second skip entries include a document identifier that is included in a boundary posting of a block of postings immediately adjacent to the skip entry in the inverted list (Page 15, [0277], lines 1 – 6, Border<sup>26</sup>; and Page 13, Section 4.1 Skipping, 6<sup>th</sup> paragraph, “... For example, suppose that p1 synchronisation points are allowed. Then the index into the inverted list contains p1 ‘document number, bit address’ pairs, and can itself be stored as a compressed sequence of ‘difference in document number, difference in bit address’...”; Moffat), where a block of postings includes postings having document identifiers ranging from a lower to an upper value and where a boundary posting is a posting having a document identifier of either the lower or the upper value (Page 16 and 18, [0286] and [0314], lines 5 – 9 and 3 – 9; respectively, Broder).

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<sup>26</sup> Wherein doc\_i corresponds to the document identifier claimed.

Additional limitations of claims 15 and 51, not included above, have been rejected under the same criteria as claims 8, 31, and 44 (See claims 8, 31, and 44 - *Claim Rejections - 35 USC § 112*- listed on this office action).

Regarding Claim 31, the combination of Broder in view of Moffat and further in view of Young discloses an inverted index of claim 25, wherein x is selected from a first range of 256 to 512 and y is selected from a second range of 128 to 256 (Col. 140, lines 30 – 43, Young), wherein y cannot be selected to have the same value as x (Page 15, [0277], lines 1 – 2, k be the smallest index, Broder; and Page 13, Section 4.1 Skipping, paragraph 1, "...suppose that p1 synchronisation points are allowed. The index into the inverted list contains p1 "document number, bit address" pairs, and can itself be stored as a compressed sequence of "difference in document number, difference in bit address run lengths...", Moffat).

### **Response to Arguments**

1. In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).
2. Applicant argues that; "Broder fails to disclose or suggest a 'skip entry'. Instead of using skip entries, Broder uses a completely different approach based on an 'iterator'" and; "As a consequence, Broder teaches away from the use of skip entries by using an 'iterator'.

Examiner respectfully disagrees. As stated in the Office Action dated May 8, 2007, the combination of Broder in view of Moffat discloses a 'skip entry' (Page 14, 1<sup>st</sup> and 2<sup>nd</sup> paragraph, "...the inverted list becomes a sequence of blocks of three pairs each, with skips separating the blocks...", and "...a2 is the address of the first bit of the **second skip pair**, a3 is the address of the first bit of the third skip, and so on...", Moffat).

Examiner also disagrees with the argument that; Broder teaches away from the skip entry by using an iterator. An iterator, as well-known in the art, is defined as an object or routine for accessing items from a list, array or stream one at a time. Additionally such iterator, disclosed by Broder, is related to skip entries (See for

example, Page 14, [0245], "...each index term is associated with a basic iterator 1125 object (a 'stream reader' object) capable of sequentially iterating over its posting list. The iterator 1125 can additionally skip to a given entry in the posting list...", Broder). Therefore, Broder does not teach away from the use of skip entries.

3. Applicant argues that; "there is no disclosure in Broder that requires Broder's 'k' to not exceed the quantity of the documents, which the Examiner appears to allege corresponds to the claimed value 'x'".

Examiner respectfully disagrees. As stated in the Office Action dated May 8, 2007, the combination of Broder in view of Moffat discloses: where  $y$  does not exceed  $x$  (Page 15, [0277], lines 1 – 2, ***k be the smallest index, Broder***). Additionally, the details in regards to "x" are disclosed in Page 17 and 18, [0307] and [0314], lines 1 – 3 and 3 – 9, Border. Wherein the top "n" documents corresponds to the quantity of documents including the majority of index terms claimed; specifically "n" corresponds to the value  $x$  claimed.

4. Regarding the motivation to combine Broder in view of Moffat, applicant argues that; "a skilled artisan would not combine such divergent references" since, according to applicant statements, "Moffat uses an approach using skips while Broder teaches away from skips by using an iterator to iterate over the actual entries using WAND function".

Examiner respectfully disagrees. As stated in this Office Action above (response to argument 2), Broder does not teach away from skip entries by using an iterator. On

the contrary, both of the references Broder and Moffat do teach features that are directed to analogous art and that are directed to the same field of endeavor, such as, databases management systems, inverted lists, skipping, and indexing.

5. Applicant argues that; "the Examiner has not made a showing that there is any reasonable expectation of success since Applicant doubts whether Broder's iterator, which relies on a specialized WAND function, would operate with Moffat's skip approach".

Examiner respectfully disagrees. Since (as shown in this Office Action above, response #2 and #4) Broder's iterator includes skipping to a given entry and Moffat's system and apparatus includes skip entries, then the combination Broder in view of Moffat would have a reasonable expectation of success.

6. Applicant argues that the applied art fails to disclose; "the ranges 256-512 and 128 to 256".

Examiner respectfully disagrees. As stated in the Office Action dated May 8, 2007, the combination of Broder in view of Moffat and further in view Young discloses the ranges 256-512 and 128 to 256 (Col. 140, lines 30 – 43, Young).

Additionally and to further clarify, it would have been obvious to one of ordinary skill in the art at the time the invention was made to select the values from those ranges, since **it has been held that where the general conditions of a claim are**

**disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.**

7. In response to applicant's argument that Young is nonanalogous art, it has been held that a prior art reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the applicant was concerned, in order to be relied upon as a basis for rejection of the claimed invention. See *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992). In this case, Young teaches features that are directed to the same field of endeavor of database management system, such as, and **values representative of locations**. This relation between the applied references highly suggests an expectation of success.

**Conclusion**

1. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.
2. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

***Prior art Made of Record***

1. Broder et al. (US Patent Application Pub. No. 2004/0243560 A1) discloses a system, method and computer program product for performing unstructured information management and automatic text analysis, including an annotation inverted file system facilitating indexing and searching.
2. Antoshenkov (US Patent No. 6,439,783 B1) discloses a range-based query optimizer.
3. Huynh et al. (US Patent No. 5,539,899) discloses a system and method for handling a segmented program in a memory for a multitasking data processing system utilizing paged virtual storage.
4. Young et al. (US Patent No. 5,838,950) discloses a method of operation of a host adapter integrated circuit.
5. Moffat et al. (Moffat hereinafter) (Non-Patent Literature: "Self-Indexing Inverted Files for Fast Text Retrieval"; Alistar Moffat, and Justin Zobel; February 1994, 1994 Australian Database Conference, and 1994 IEEE Conference on Data Engineering)

***Points Of Contact***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Giovanna Colan whose telephone number is (571) 272-2752. The examiner can normally be reached on 8:30 am - 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Breene can be reached on (571) 272-4107. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Giovanna Colan  
Examiner  
Art Unit 2162  
September 19, 2007



SANA AL-HASHEMI  
PRIMARY EXAMINER